ENVIRONMENTAL IMPACTS:

Introduction:

This section presents the potential direct, indirect and cumulative impacts to hydrological resources from each of the alternatives.

Direct impacts are those that are caused by the action are occur at the same time and place (40 CFR 1508.8), while indirect impacts are those that are caused by the action but occur later in time or are removed in distance, but are still reasonably foreseeable (40 CFR 158.8). As the direct and indirect impacts are closely related for this project they are presented together in this report.

Cumulative impacts are those that result from the incremental impacts of the action when added to other past, present or reasonably foreseeable future actions regardless of which agency or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7). The cumulative projects that are considered in this analysis are presented under the No Action Alternative in the Alternatives Analyzed section, and in Appendix A.

Alternative A: No Action

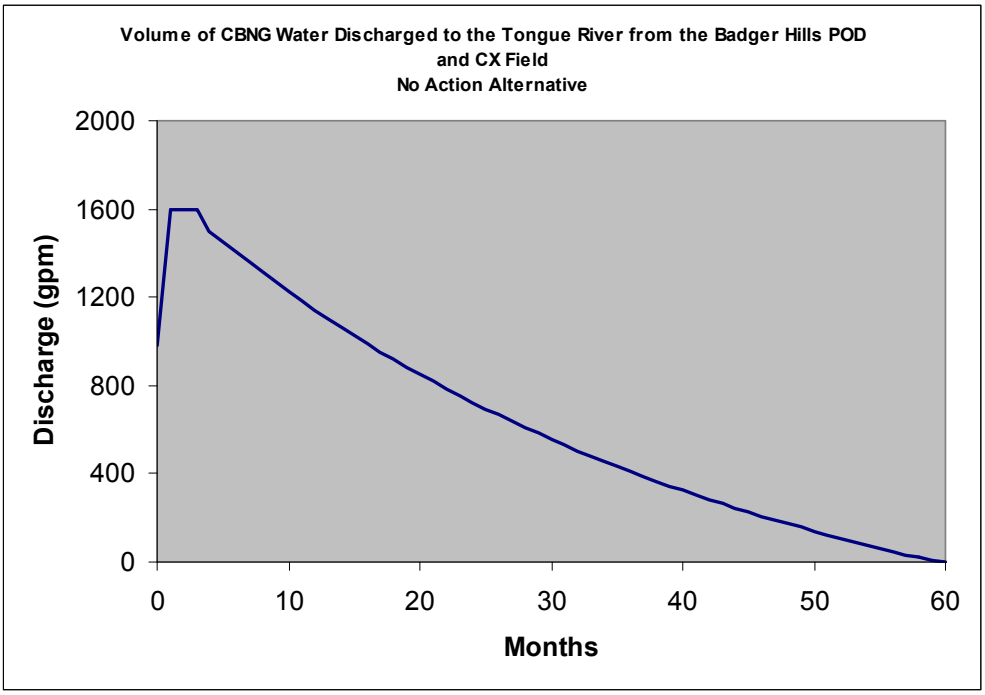
Direct and Indirect Impacts

The direct and indirect impacts for the No Action Alternative result from the drilling and production of the State and Fee wells in the Badger Hills POD and from the instillation of the required infrastructure. As the water from these wells would be managed in conjunction with the water produced by the CX field, the water production from the CX field is taken into account in this direct impacts section rather than under the cumulative impacts section. Construction or drilling activities would not be authorized for the federal wells within the Badger Hills CBNG POD, nor would the infrastructure needed solely for production of the federal wells be constructed.

The beneficial use of 235 gpm of CBNG produced water by the Spring Creek Coal Mine, and 370 gpm by Decker Coal Mine for industrial purposes, such as dust control, is not anticipated to impact surface water or ground water resources. This water would evaporate, and a small portion infiltrate through this use. Since the areas wetted in this way will not be continually saturated the migration of the salts contained in this water will be extremely slow. During the migration process the water which allows these salts to move will also dissolve soluble minerals (such as Gypsum; $CaSO_4 \cdot 2H_2O$) contained in the soil and bedrock, thereby causing the SAR to decrease and the EC to increase. Ion exchange processes with clays will also cause changes in the chemistry of the chemistry of the subsurface water. These changes will cause the chemistry of this water to be similar to that of infiltrated rainwater. Over the long term the excess sodium introduced to the subsurface in this way will make its way to either groundwater or surface water; however the rate at which it is released would be so slow as to be unnoticeable.

Surface Water

It is anticipated that Fidelity will use their full 1,600 gpm (3.56 cfs) of permitted discharge even if the federal wells within the Badger Hills POD were not drilled. This produced water would come from both the Badger Hills POD area and the CX Field. Based upon the water balance calculations conducted for this analysis, it is anticipated that the full 1,600 gpm would be discharged for 3 months under this alternative. The discharge to the Tongue River would be anticipated to return to current levels (984 gpm) in approximately 17 months under the No Action Alternative (See Appendix B). The anticipated discharge to the Tongue River vs. time is shown in the chart below.



As discussed in the affected environment section, the EC of the produced water is anticipated to be approximately 1,987 µS/cm and the SAR is anticipated to be approximately 54.

A surface water model was used to determine the surface water quality that would result from discharges into the Tongue River. This model uses a steady-state, mass-balance approach to estimate values for EC, Na, Ca, and Mg after two or more inflows are mixed. This approach assumes complete mixing, and so the results are only valid outside of the mixing zones associated with the outfalls. In this model the maximum permitted discharge of 1,600 gpm (3.56 cfs) was used for the Badger Hills/CX Field. 450 gpm (1 cfs) was used for the Coal Creek POD. Mixing effects of the Tongue River Reservoir are also assessed. Discharges from the coal mines are included in the reservoir component of the surface water model. SAR values are calculated from resultant ion concentrations. The results of these calculations are shown in Table 5 below. The surface water model used to calculate the resultant surface water quality values is discussed further in Appendix C.

Table 5. Direct Impacts from 1600 gpm discharge of CBNG Water from the Badger Hills POD Area and CX Field

	Tongue River at State Line					
	Existing Conditions (1985-2002)*			Direct Surface Water Impacts		
	Flow (cfs)	EC (µS/cm)	SAR	Flow (cfs)	EC (µS/cm)	SAR
7Q10	35	1193	1.42	39	1266	2.37
Low Monthly Mean	176	636	0.70	180	663	0.98
High Monthly Mean	1638	267	0.26	1642	270	0.31

	Tongue River Below Dam					
	Existing Conditions (1975-2002)*			Direct Surface Water Impacts		
	Flow (cfs)	EC (µS/cm)	SAR	Flow (cfs)	EC (µS/cm)	SAR
7Q10	23	1043	1.24	27	1064	1.58
Low Monthly Mean	173	657	0.70	177	676	1.01
High Monthly Mean	1429	281	0.28	1433	284	0.31

	Tongue River at Birney Day School					
	Existing Conditions (1979-2002)*			Direct Surface Water Impacts		
	Flow (cfs)	EC (µS/cm)	SAR	Flow (cfs)	EC (µS/cm)	SAR
7Q10	49	1125	1.56	53	1146	1.90
Low Monthly Mean	179	717	1.02	183	736	1.33
High Monthly Mean	1119	379	0.56	1123	382	0.59

* These values include the effects of CBNG in Wyoming. No new discharges into the Tongue River are being permitted in Wyoming.

The 7Q10 Values for the State Line and Birney Day School Station have changed from the original EA due to updated USGS data.

Actual variations in surface water chemistry will be monitored through the MPDES permitting process, and the USGS gauging stations on the Tongue River. If monitoring results indicated that surface water quality standards may be exceeded the MT-DEQ may require that appropriate action be taken to ensure that surface water quality standards are met. This may require decreasing or ceasing discharge to the Tongue River until a revised WMP which ensures that surface water quality standards are met is developed and approved. Under this Alternative the BLM would have no regulatory oversight of the project.

The Montana Board of Environmental Quality has established surface water standards for EC and SAR. These standards have been reviewed and approved by the EPA, and therefore have Clean Water Act standing. The Northern Cheyenne Tribe has also adopted surface water quality standards for EC and SAR. The Northern Cheyenne Tribe has not currently been granted "Treatment as a State" status by the EPA, and therefore the EPA has not reviewed these standards. As such the Northern Cheyenne numerical standards do not have Clean Water Act standing; however they do set out the Tribe's considered determination of the water quality needed to protect irrigated agriculture on the Reservation (BLM, 2003). Therefore the Northern Cheyenne standards provide reasonable criteria against which to compare the resulting water quality at the southern boundary of the Northern Cheyenne Reservation. These various standards are summarized in Table 6 below and are shown on Charts 1, 2, and 3 in the figures section. The standards are in terms of monthly mean values or instantaneous maximum values.

Table 6

Surface Water EC and SAR Standards for the Tongue River

	Monthly Mean SAR	Inst. Max SAR	Monthly Mean EC (µS/cm)	Inst. Max EC (µS/cm)
MT-DEQ Irrigation Season[1] Standards	3.0	4.5	1000	1500
MT-DEQ Non-Irrigation Season[1] Standards	5.0	7.5	1500	2500
Northern Cheyenne Irrigation Season[1] Standards; Southern Boundary	---	2.0	1000	2000
Northern Cheyenne Non-Irrigation Season[1] Standards; Southern Boundary	---	2.0	---	2000

1: The Irrigation Season specified by the MT-DEQ is from March 1st to October 31st while the Irrigation Season specified by the Northern Cheyenne is from April 1st to November 15th.

The high mean monthly and low mean monthly results should be compared to the mean monthly standards, while the 7Q10 result should be compared to the instantaneous maximum standards. The 7Q10 value is a standard regulatory value used to address instantaneous maximum standards. This is appropriate since the 7Q10 is the lowest flow that would be expected to occur for 7 consecutive days over any 10 year period. The 7Q10 flow value is much less than the mean monthly values. For example, in the Tongue River at the state line station, the 7Q10 flow is 35 cfs while the Low Monthly Mean flow is 176 cfs and the High Monthly Mean flow is 1638 cfs.

Comparison of the resultant water quality values to the appropriate standards shows that during high mean monthly and low mean monthly flows none of the mean monthly standards are exceeded. During 7Q10 flows the instantaneous maximum standards are not exceeded. During the 7Q10 flow the mean monthly irrigation season EC standards are exceeded for all stations, however as mentioned above these are not appropriate standards for comparison. The natural in-stream water quality during 7Q10 flow at all stations also exceeds these standards. The no action alternative will not cause any of the appropriate surface water standards for EC or SAR to be exceeded. These standards were adopted for the express purpose of protecting all beneficial uses of the Tongue River, including agriculture, aquatic life, drinking water, industrial uses, and recreational uses. As such, the results of this analysis indicate that the beneficial uses of the Tongue River will not be impaired by implementation of the no action alternative.

The MDEQ has also analyzed the effects of this discharge for all numerical and narrative surface water standards. The MDEQ has determined that the 1,600 gpm discharge will not impact beneficial uses. The MDEQ is currently in the process of reviewing this permit in light of the new EC and SAR standards, particularly with regard to the provision of these standards which call for flow based permitting. The MDEQ must review permits to discharge at least once every 5 years.

Under the no action alternative the maximum volume of water produced would be approximately 2,257 gpm from the Badger Hills and CX Fields. The existing MPDES discharge permit (1,600 gpm) and beneficial use of the water for coal mines (605 gpm) along with existing storage in the CX Field would be adequate to manage this produced water; however, as discussed in the No Action Alternative in the Alternatives Analyzed section, Fidelity has indicated that the proposed impoundments and irrigation areas would be still be constructed.

The 3 new impoundments (34-3490, 44-3490, and 22-3590) and the 1 existing (33-3390) impoundment have been, or will be, constructed with low permeability clay liners to prevent infiltration. Since evaporative concentration of the water in the pits may occur, the salinity of the water could become elevated, depending on the rates of water addition and removal. If the salinity of the water in the impoundments became too high, it could have adverse impacts on wildlife or livestock. If water were to infiltrate through the liner, it would have the potential to dissolve soluble salts and partake in caution exchange reactions with clays in the underlying bedrock. These reactions are likely to cause the SAR of the water to be decreased, and the EC to be increased. These waters would have the potential to flow through permeable bedrock units to outcrop, thereby forming saline seeps. The quality of the water emitting from such seeps could be quite low, and impacts to local vegetation could occur. If these seeps occurred near surface waters, there would also be the potential to affect surface water quality. Under this alternative, the required monitoring would be that required by the MBOGC (see appendix D).

These impoundments are located off drainage, in headwater areas. As such, they would not intercept a noticeable volume of the water that would normally flow downstream. The only interception would be that from direct precipitation on the impoundments and from the limited areas that drain to them. A summary of the impoundments is provided in Table 4.2.6-3. The impoundments would be constructed and operated to accommodate runoff from a 100-year storm event in 24 hours. An emergency spillway would be installed in each impoundment. As such, it is not anticipated that these impoundments would overflow. If an impoundment were to overflow, the dilution added to the impoundment by the rainfall would decrease the salinity of the water in the impoundment. The volume of flow down-drainage would be the same as if no impoundment were present as the surface area would be the same. The impoundment would not be anticipated to "blow-out" since an emergency spillway would be present.

Table 7: Badger Hills Off Channel Lined Impoundments

Facility Name	Status	Location				Capacity (Ac-ft)	Surface Area (Acres)	Contributing Drainage Area (Acres)
		Town	Rng	Sec	Qtr			
34-3490	Proposed	9	40	34	SWSE	109	8.2	10.24
44-3490	Proposed	9	40	34	SESE	228.3	14.4	7.68
22-3590	Proposed	9	40	35	SENW	122	7.2	22.4
33-3390	Existing	9	40	33	NWSE	4.14	0.77	21.76

Upon cessation of use, the impoundments will be reclaimed or left in place for livestock or wildlife use, depending on the desires of the surface owner.

Irrigation with the CBNG produced water on the 170 acres is not anticipated to effect surface waters. When irrigation is taking place monitoring personnel will be present to prevent the direct flow of produced water into Badger Creek. Irrigation rates will regulated so that the infiltration rate of the least permeable soil horizon will not be exceeded. This will cause the applied water to flow vertically down into the subsurface rather than flowing horizontally. If excess water were applied along Badger Creek, the infiltrated water could infiltrate, intersect an aquatard and flow horizontally to the stream. If excess water were applied to the irrigation area on the bench the infiltrated water could intersect an aquatard and flow horizontally to the outcrop. After these waters had infiltrated they would have the potential to dissolve soluble salts (such as gypsum ($CaSO_4 \cdot 2H_2O$)) and partake in cation exchange reactions with clays in the underlying bedrock (typically exchanging Na for Ca and Mg). These reactions are likely to cause the SAR of the

water to be decreased, and the EC to be increased (increased salinity). Once these waters reached the surface (stream or outcrop) they could form saline seeps. No monitoring wells would be installed under this alternative, making it difficult to determine if the assumptions needed for determining irrigation rates were correct.

Under the no action alternative, the construction and drilling activities associated with the state and fee wells in the Badger Hills POD would cause the disturbance of vegetation, and cause corresponding increases in soil erosion rates. Approximately 200 acres of disturbance are anticipated to result in the Badger Hills POD area under the No Action Alternative. Approximately 79 acres of this disturbance would be short term (< 5 years; well pads and utility corridors), with reclamation occurring following construction activities. The remaining 121 acres are long term (> 5 years) disturbance mainly associated with impoundments (80 acres), roads (30 acres), and gathering/metering facilities (10 acres). The majority of the area disturbed by impoundments would not yield sediment downstream. Increased soil erosion could cause increases in suspended sediment loads to local surface waters. The increase in suspended sediments to surface waters resulting from disturbance should be minor, based on the operator's plans and the presence of sediment filtering vegetation between the disturbed areas and live waters.

Groundwater

Under the No Action Alternative the State and Fee wells would be drilled, tested, and produced if productive. The removal of water from the coal seams would cause a cone of depression to form around each well. The radius that the drawdown would extend from the produced field was calculated using the Theis Equation and regional aquifer characteristics. The results of this analysis are shown in Table 8 below. Additional discussion of these drawdown calculations is provided in Appendix F.

Table 8

Summary of Predicted Drawdown

No Action Alternative

Years Pumped	Average Pumping Rate (gpm)	Coal Seam	Radius of 20' Contour (miles)
1 Year	12.6	Dietz 1	0.90
		Dietz 2	0.80
		Dietz 3	0.77
		Monarch	0.86
		Carney	0.88
5 Years	8.2	Dietz 1	1.9
		Dietz 2	1.7
		Dietz 3	1.7
		Monarch	1.9
		Carney	1.9
10 Years	5.3	Dietz 1	2.6
		Dietz 2	2.3
		Dietz 3	2.3
		Monarch	2.5
		Carney	2.5
20 Years	2.9	Dietz 1	3.1
		Dietz 2	2.9
		Dietz 3	2.9
		Monarch	3.1
		Carney	3.1

K = 1.1 feet/day S = 9×10^{-4}

Under the No Action Alternative the 20 foot drawdown contour that results from the State and Fee wells within the Badger Hills POD is estimated to extend up to 3.1 miles from the produced field. These results compare well with the results of the 3D groundwater model prepared in support of the MT EIS (Wheaton and Metesh, 2002), which indicates that the 20 foot drawdown contour from a simulated 1,082 CBNG well field, with wells finished in 3 coal seams, may extend up to 5 miles from the edge of production. The actual drawdown would be dependent on the site-specific aquifer characteristics and actual pumping rates.

A reduction in hydrostatic head could cause water wells finished in the produced coal seams within the radius of drawdown to have reduced yields. Due to the low vertical hydraulic conductivity of the Tongue River member of the Fort Union Formation, aquifers other than the produced coals are not anticipated to be affected. Water wells would not be anticipated to go dry since during the production of CBNG the coal seam hydrostatic pressure is decreased, but the coal remains saturated. Those springs which emit from the coal seams being produced and are located within the area over which drawdown occurs would have decreased yield, or may go dry. In fact, at the time of the writing of this report it has been reported (Billings Gazette, 1/30/04) that 3 domestic water wells have been impacted by CBNG development in Wyoming. These wells lay outside the area anticipated to be impacted by the Badger Hills POD.

A total of 378 wells and 1 spring exist within the 3.1 mile buffer zone around the Badger Hills POD. Of these wells, 337 are monitoring wells and 41 are domestic or stock wells. Of these domestic and stock wells 36 wells are located within the potential drawdown areas associated with the existing CX Field and Wyoming CBNG development. The one spring (THOMPSON J.W. *14 MI S OF BIG BEND SCHOOL) is also located within the existing potential drawdown area. The direct drawdown area under the No Action Alternative has a total area of 87 square miles. Only those wells completed in the coal seams being developed are anticipated to have the potential to be affected by CBNG development. Of the springs in the buffered area, only those that emit from the coal seams being developed would have the potential to be affected. Most springs in this area emit from the clinker deposits found along the ridge tops. A detailed listing of the wells and springs contained within the 3.1 mile drawdown area and a map of these wells and springs are provided in Appendix G.

This reduction in pressure within the coal seams could also cause methane gas (CH_4) to become desorbed more easily from the coal surfaces. In the cases where the pressure is sufficiently reduced to cause desorption by a CBNG well, the methane released would flow towards that CBNG well and be sent to market. In some cases, the drawdown from CBNG development would not be sufficient to cause desorption, however it would reduce the pressure in the coal seam. In such a case, the water wells finished in the produced coal seam could cause desorption of gas at pumping rates which historically would not have caused this gas to be desorbed. This may impact the usability of these water wells.

Based upon the groundwater modeling conducted in support of the MT EIS, it is anticipated that the produced coal seams would recover 70% of their hydrostatic head within 5-12 years after the end of production. The exact radius of the drawdown cone, and the time required for the head to recover, would depend on the site specific aquifer properties. For additional general discussion of the anticipated drawdown related impacts, please see pages 4-61 to 4-63 of the MT-CBM-FEIS (BLM, 2003), and the associated groundwater modeling reports (Wheaton and Metesh 2001, Wheaton and Metesh, 2002).

The operator has committed to comply with all applicable Federal, State and Local laws and regulations. This includes the DNRC's designation of the Powder River Basin Controlled Groundwater area. This order requires that operators offer water mitigation agreements to owners of water wells or natural springs within one mile of a CBNG field, or within the area that the operator reasonably believes may be impacted by a CBNG production, whichever is greater, and to extend this area one-half mile beyond any well adversely affected. These mitigation agreements apply to any spring or well adversely effected by CBNG development (MT-DNRC, 1999). As such, these agreements would apply to those wells which experience an impact to their use whether it is due to decreased yields, the production of methane, or a change in water quality. The operator has also committed to provide water well agreements to the owners of record for permitted water wells within the area of influence of the action. The terms of these agreements would be those agreed to by the water source owner and the operator. The typical Fidelity water mitigation agreements terminate upon the expiration of the last Oil and Gas Lease or the plugging and abandonment of the last CBNG well to which the agreement applies, whichever is the later date. The replacement of water required by these agreements is anticipated to take the form of reconfiguring existing wells, re-drilling wells, or drilling new wells. It is anticipated that these processes would be effective for replacing water sources since the drawdown from CBNG activity is anticipated to be confined to the coal seam aquifers, and not noticeably effect other aquifers (such as sandstones) within the Tongue River Member of the Fort Union Formation. Any impacted water sources would be replaced with a permanent source before the termination of the agreement. Impacts would not be expected after the cessation of CBNG development since

the aquifer would then be in the recovery phase, with groundwater levels rising in the area that had been drawdown by CBNG development. Therefore, it is anticipated that these required water mitigation agreements would mitigate the potential impacts from groundwater drawdown, methane migration or changes in groundwater quality.

Cumulative Impacts

The cumulative impacts to hydrologic resources under the No Action Alternative are those that would result from the State and Fee CBNG wells within the Badger Hills POD added to other actions that have the potential to combine to create environmental impacts.

Surface Water

As discussed in Appendix A, those cumulative actions included in this analysis include the existing wells in the CX field, the proposed CX field infield drilling, the proposed Coal Creek POD, and the East and West Decker coal mines.

The surface water chemistry of the Tongue River would be affected by the proposed Coal Creek CBNG POD which would be discharging treated CBNG water downstream from the Tongue River Dam. The water balance calculations conducted for the Coal Creek POD indicate that a maximum discharge rate of 450 gpm, decreasing at a rate of 20% per year. The discharged water from the Coal Creek POD would have an EC of approximately 493 μS/cm and an SAR of approximately 0.03. As this discharge would be directly into the Tongue River, it is taken into account in the analysis of cumulative impacts to surface waters.

Effects from the water produced by the CX field are discussed under the direct impacts section of this analysis as this water would be managed together. The discharges from the East and West Decker Coal Mines are included in the surface water model as existing conditions.

The cumulative effects of all of these cumulative discharges are summarized in Table 9 below. The No Action Alternative would not cause any of the appropriate surface water standards for EC or SAR to be exceeded (See Table 6). These standards were adopted for the express purpose of protecting all beneficial uses of the Tongue River, including agriculture, aquatic life, drinking water, industrial uses, and recreational uses. As such, the results of this analysis indicate that the beneficial uses of the Tongue River would not be impaired by implementation of the No Action Alternative.

Table 9: Cumulative Effect of Discharges

	Tongue River at State Line								
	Existing Conditions (1985-2002)*			Direct Impact of Badger Hills			Cumulative Surface Water Impacts		
	Flow (cfs)	EC (µS/cm)	SAR	Flow (cfs)	EC (µS/cm)	SAR	Flow (cfs)	EC (µS/cm)	SAR
7Q10	35	1193	1.42	39	1266	2.37	39	1266	2.37
Low Monthly Mean	176	636	0.70	179.5	663	0.98	179.5	663	0.98
High Monthly Mean	1638	267	0.26	1642	270	0.31	1642	270	0.31

	Tongue River Below Dam								
	Existing Conditions (1975-2002)*			Direct Impact of Badger Hills			Cumulative Surface Water Impacts		
	Flow (cfs)	EC (µS/cm)	SAR	Flow (cfs)	EC (µS/cm)	SAR	Flow (cfs)	EC (µS/cm)	SAR
7Q10	23	1043	1.24	27	1064	1.58	28	1043	1.54
Low Monthly Mean	173	657	0.70	177	676	1.01	178	675	1.00
High Monthly Mean	1429	281	0.28	1433	284	0.31	1434	284	0.31

	Tongue River at Birney Day School								
	Existing Conditions (1979-2002)*			Direct Impact of Badger Hills			Cumulative Surface Water Impacts		
	Flow (cfs)	EC (µS/cm)	SAR	Flow (cfs)	EC (µS/cm)	SAR	Flow (cfs)	EC (µS/cm)	SAR
7Q10	49	1125	1.56	53	1146	1.90	54	1134	1.87
Low Monthly Mean	179	717	1.02	183	736	1.33	184	735	1.32
High Monthly Mean	1119	379	0.56	1123	382	0.59	1124	382	0.59

* These values include the effects of CBNG in Wyoming. No new discharges into the Tongue River are being permitted in Wyoming.
The 7Q10 Values for the State Line and Birney Day School Station have changed from the original EA due to updated USGS data.

Groundwater

As discussed in Appendix A, those cumulative actions included in this analysis include the CX field, CBNG development in Wyoming, the proposed, the proposed Coal Creek POD, and the East and West Decker coal mines.

When all of these projects are combined and a 3.6 mile buffer is applied (the rational for which is discussed under the Proposed Action Alternative), a total of 568 wells and 27 springs exist within the cumulative buffer. Of these wells, 479 are monitoring wells and 89 are domestic or stock wells. Of these domestic or stock wells 72 are currently located within the potential drawdown areas associated with the CX Field and Wyoming CBNG development. A complete listing of the wells and springs that are located within the existing potential cumulative drawdown area and in the predicted cumulative potential drawdown area that would result from No Action being added to the existing conditions can be found in Appendix H. The impacts to these wells and springs would be similar to that described under the direct section of the No Action Alternative analysis, with wells located within the drawdown cone and completed within the produced coal seams experiencing decreased yields, and springs located within the drawdown cone and emitting from the produced coal seams having decreased flow, or going dry. As discussed in the direct impacts section, it is anticipated that impacted water sources would be replaced with a permanent source before the termination of the agreement. Impacts would not be expected after the cessation of CBNG development. Therefore it is anticipated that water mitigation agreements, as required by the designation of the Powder River Basin Controlled Groundwater area would mitigate the potential impacts from groundwater drawdown, methane migration or changes in groundwater quality.

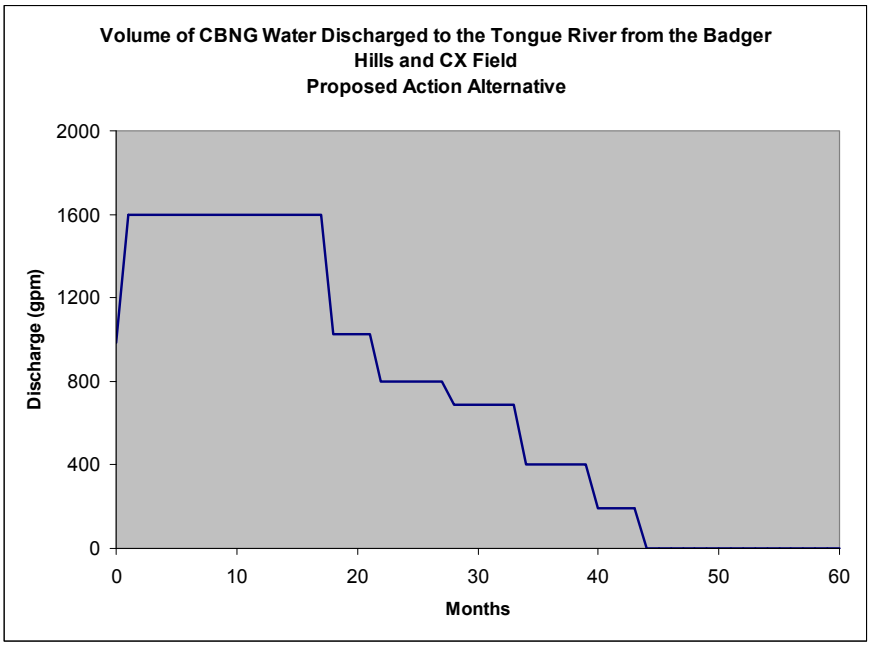
Proposed Action:

Proposed Action Direct and Indirect Impacts:

Surface Water

The proposed action would include discharge of 1,600 gpm (3.56 cfs) of CBNG produced water into the Tongue River upstream from the Tongue River Reservoir under Fidelity's existing MPDES discharge permit. This water would be derived from the CX Field, and the State, Fee and federal wells within the Badger Hills POD. Energy dispersing outfall structures have been or will be constructed to prevent excessive erosion at the discharge points. As discussed in the affected environment section above, the EC of this water is anticipated to be approximately 1,987 µS/cm and the SAR is anticipated to be approximately 54.

This 1,600 gpm is the same volume and quality of water as would be discharged under the No Action Alternative. The in-stream water quality that would result from this discharge is depicted in Table 5 in the No Action section of this report. The difference in direct impacts to surface waters compared to the No Action Alternative is the duration of the potential effects. According to the water balance calculations conducted for this analysis this volume of discharge would be needed for 17 months under the Proposed Action Alternative rather than the 3 months required by the No Action Alternative. Discharge volumes would return to current levels (984 cfs) after approximately 22 months under the Proposed Alternative as opposed to 17 months under the No Action Alternative (See Appendix B). A graph of the anticipated discharge to the Tongue River vs. Time under the Proposed Action Alternative is shown below.



As with the No Action Alternative, implementation of the proposed action will not cause any of the appropriate surface water standards for EC or SAR to be exceeded (See Table 6). These standards were adopted for the express purpose of protecting all beneficial uses of the Tongue River, including agriculture, aquatic life, drinking water, industrial uses, and recreational uses. As such, the results of this analysis indicate that the beneficial uses of the Tongue River will not be impaired by implementation of the proposed action. If monitoring under the MPDES program or from the USGS stations indicates that surface water quality standards may be exceeded appropriate action will be needed to ensure that water quality standards are met. This may

require the BLM to shut in federal wells until a modified WMP can be developed which ensures that surface water quality standards are met.

The impacts from the impoundments and the irrigation areas would be the same as described under the No Action Alternative except that the monitoring requirements identified in Section I.B the MT-DEQ Draft General Discharge Permit for CBM, the monitoring wells adjacent to the impoundments, and the monitoring wells associated with the irrigation areas would be added as COAs to the APDs. This additional monitoring, which could not be applied under the No Action Alterative, provides for the ability to modify management practices, if needed, and should be adequate to prevent adverse impacts from the impoundments. Upon cessation of use, the impoundments will be reclaimed or left in place for livestock or wildlife use, depending on the desires of the surface owner. If the impoundments are removed, the land must be returned to its previous utility and stability.

Implementation of the proposed action would also cause disturbance of vegetation, and cause corresponding increases in soil erosion rates. Approximately 298 acres of disturbance are anticipated to result from the proposed action. Approximately 160 acres of this disturbance would be short term (< 5 years; well pads and utility corridors), with reclamation occurring following construction activities. The remaining 138 acres are long term (> 5 years) disturbance mainly associated with impoundments (80 acres), roads (45 acres), and gathering/metering facilities (12 acres). The majority of the area disturbed by impoundments would not yield sediment downstream. Increased soil erosion could cause increases in suspended sediment loads to local surface waters. The increase in suspended sediments to surface waters resulting from disturbance should be minor, based on the operator's plans, the BLM applied mitigation and the presence of sediment filtering vegetation between the disturbed areas and live waters. The direct impact of the proposed action is to increase long term (> 5 years) disturbance by 17 acres and to increase short term disturbance by 82 acres.

Groundwater

Under the proposed action all proposed federal, state and fee wells would be drilled, tested, and produced if productive. Using the same methods discussed in the No Action Alternative, the distance drawdown would extend from the Badger Hills POD area was estimated for the Proposed Action. The major difference between these analyses is that there are more wells pumping from each coal seam under the Proposed Action Alternative and so the radius of drawdown increases. The results of this analysis are shown in Table 8 below. Additional discussion of these drawdown calculations is provided in Appendix F of this report.

As shown in Table 10 below, the 20 foot drawdown contour may extend up to 3.6 miles from the produced field. The major difference in the direct impacts to groundwater relative to the No Action Alternative is the increase in the radius of 20 foot drawdown contour by approximately ½ mile, from 3.1 miles to 3.6 miles. These results compare well with the results of the 3D groundwater model prepared in support of the MT-CBM EIS (Wheaton and Metesh, 2002), which indicates that the 20 foot drawdown contour may extend up to 5 miles from the edge of a simulated 1082 well field. The actual drawdown will be dependent on the site specific aquifer characteristics and actual pumping rates.

Table 10: Summery of Predicted Drawdown Under the Proposed Action

		Drawdown Radius(miles)	
Years Pumped	Coal Seam	No Action	Proposed Action
		20 foot	20 foot
1 Year	Dietz 1	0.90	0.94
	Dietz 2	0.80	0.83
	Dietz 3	0.77	0.79
	Monarch	0.86	0.89
	Carney	0.88	0.91
5 Years	Dietz 1	1.9	2.0
	Dietz 2	1.7	1.8
	Dietz 3	1.7	1.7
	Monarch	1.9	1.9
	Carney	1.9	2.0
10 Years	Dietz 1	2.6	2.8
	Dietz 2	2.3	2.5
	Dietz 3	2.3	2.4
	Monarch	2.5	2.7
	Carney	2.5	2.7
20 Years	Dietz 1	3.1	3.6
	Dietz 2	2.9	3.3
	Dietz 3	2.9	3.2
	Monarch	3.1	3.5
	Carney	3.1	3.6

K = 1.1 feet/day S = $9x10^{-4}$

Impacts from drawdown under the Proposed Action Alternative would be similar to those described under the No Action Alternative, with wells located within the drawdown cone and completed within the produced coal seams experiencing decreased yields, and springs located within the drawdown cone and emitting from the produced coal seams having decreased flow, or going dry. The major direct impact to groundwater under the Proposed Alternative is that the area within the 20' drawdown contour is larger by approximately 18 square miles. This increase in area causes 1 more domestic or stock wells to be within the potential drawdown area under the Proposed Action than under the No Action Alternative. No springs are added to the potential drawdown area. The additional wells are listed in Table 11 below.

Table 11

Wells Added to the Potential Drawdown Area under the Proposed Action

(Data from GWIC and NHD)

Site Name	Use	Township	Range	Sec	Tract	County	Type	Depth
PETER KIEWIT SONS	M	09S	41E	14	BCA	BIG HORN	WELL	30
DECKER COAL	M	09S	41E	5	CCB	BIG HORN	WELL	32
PETER KIEWIT SONS	M	09S	41E	14	BCA	BIG HORN	WELL	32
DECKER COAL	M	09S	41E	6	DCA	BIG HORN	WELL	38
MBMG RESEARCH WELL WRE-25	M	09S	41E	5	DCCA	BIG HORN	WELL	114.5
PETER KIEWIT SONS CO	M	09S	41E	6	DAB	BIG HORN	WELL	140
MBMG RESEARCH WELL WRE-24	M	09S	41E	5	DCCA	BIG HORN	WELL	154
PETER KIEWIT SONS	M	09S	41E	15	AAD	BIG HORN	WELL	159
PETER KIEWIT SONS	M	09S	41E	15	AAD	BIG HORN	WELL	160
MBMG RESEARCH WELL WRE-23	M	09S	41E	5	DCBD	BIG HORN	WELL	240
ELDER WILLIS W.	D	09S	41E	26	BA	BIG HORN	WELL	252

Recovery of aquifers following development will be similar to that described in the No Action Alternative, with 70% recovery of hydrostatic head within 5-12 years after the end of production. The exact radius of the drawdown cone, and the time required for the head to recover, will depend on the site specific aquifer properties. For additional general discussion of the anticipated drawdown related impacts please see pages 4-61 to 4-63 of the MT-CBM-FEIS (BLM, 2003), and the associated groundwater modeling reports (Wheaton and Metesh 2001, Wheaton and Metesh, 2002).

The operator has committed to comply with all applicable Federal, State and Local laws and regulations, including the DNRC's designation of the Powder River Basin Controlled Groundwater area. As discussed in the No Action Alternative, the water mitigation agreements required by this designation will prevent potential adverse impacts from the groundwater drawdown associated with the proposed action.

As discussed in the No Action Alternative, the lining of the impoundments is expected to prevent leakage from the impoundments, and therefore prevent any impacts to groundwater resources. The BLM applied COAs for monitoring of these impoundments, which could not be applied under the No Action Alternative, will ensure that these impoundments, do not adversely affect groundwater.

As discussed in the No Action Alternative the application of produced water to the irrigation areas along Badger Creek and on the bench is not anticipated to adversely affect groundwater since water application will be rates that will infiltrate vertically. The BLM applied COAs for monitoring wells will ensure that these irrigation areas do not adversely affect groundwater.

The potential for cross contamination of aquifers will be avoided by cementing from the top of the produced coal zone to the surface. For further details on the drilling and cementing program see the Master Surface Use Plan and Drilling Plan in the individual APDs.

Cumulative Impacts:
The cumulative impacts under the Proposed Action Alternative would be the same as depicted under the No Action Alternative, with the addition of the direct impacts resulting from the Proposed Action.

The magnitude of impacts to surface waters would be the same as described in the No Action Alternative; however the duration of these impacts would be greater, as described in the direct impacts section of the Proposed Action Alternative. These impacts do not cause surface water quality standards to be exceeded, and therefore it is anticipated that beneficial uses would not be impacted.

The impacts to groundwater would be of the same type described in the No Action Alternative; however, the radius of the drawdown is greater by approximately ½ mile. This increase in radius causes one more domestic or stock well to be included in the potential drawdown area than under the No Action Alternative. A complete listing of the potentially impacted wells is provided in Appendix H. The implementation of the requirements of the Powder River Basin Controlled Groundwater Area designation would mitigate the impacts that may result from groundwater drawdown.